

Mechanical Properties of Cross-linked Membranes						
Ion-conducting base material	Cross-linking additive	Tensile (25C, 50% RH)	Tensile (70C, under water)	Modulus (25C)	Modulus (70C)	% Elong. (25C)
35% Sulfonated Poly Ether Ketone (sPEK)	None	2.3	1.6	38.0	35.0	49.0
35% sPEK	1% PEK (5000amu)	2.5	1.4	16.0	12.0	117.0
35% sPEK	3% PEK (5000 amu)	4.2	2.2	220.0	44.3	153.0
35% sPEK	5% PEK (5000 amu)	4.0	2.9	89.0	92.0	89.0
35% sPEK	None					
35% sPEK	1% PEK (3000amu)	2.3	2.1	69.0	46.0	55.8
35% sPEK	3% PEK (3000 amu)	3.7	2.7	1219	88.5	70.4
35% sPEK	5% PEK (3000 amu)	4.3	2.4	157.0	101.0	8.4
35% sPEK	None					
35% sPEK	1% sPEK (2500 amu, 20% Sulfonated)	2.7	2.2	120.0	72.0	19.5
35% sPEK	3% sPEK (2500 amu, 20% Sulfonated)	2.6	1.7	60.3	43.0	28.0
35% sPEK	5% sPEK (2500 amu, 20% Sulfonated)	2.4	1.7	56.4	35.4	33.6
						114.8

Fig. 1

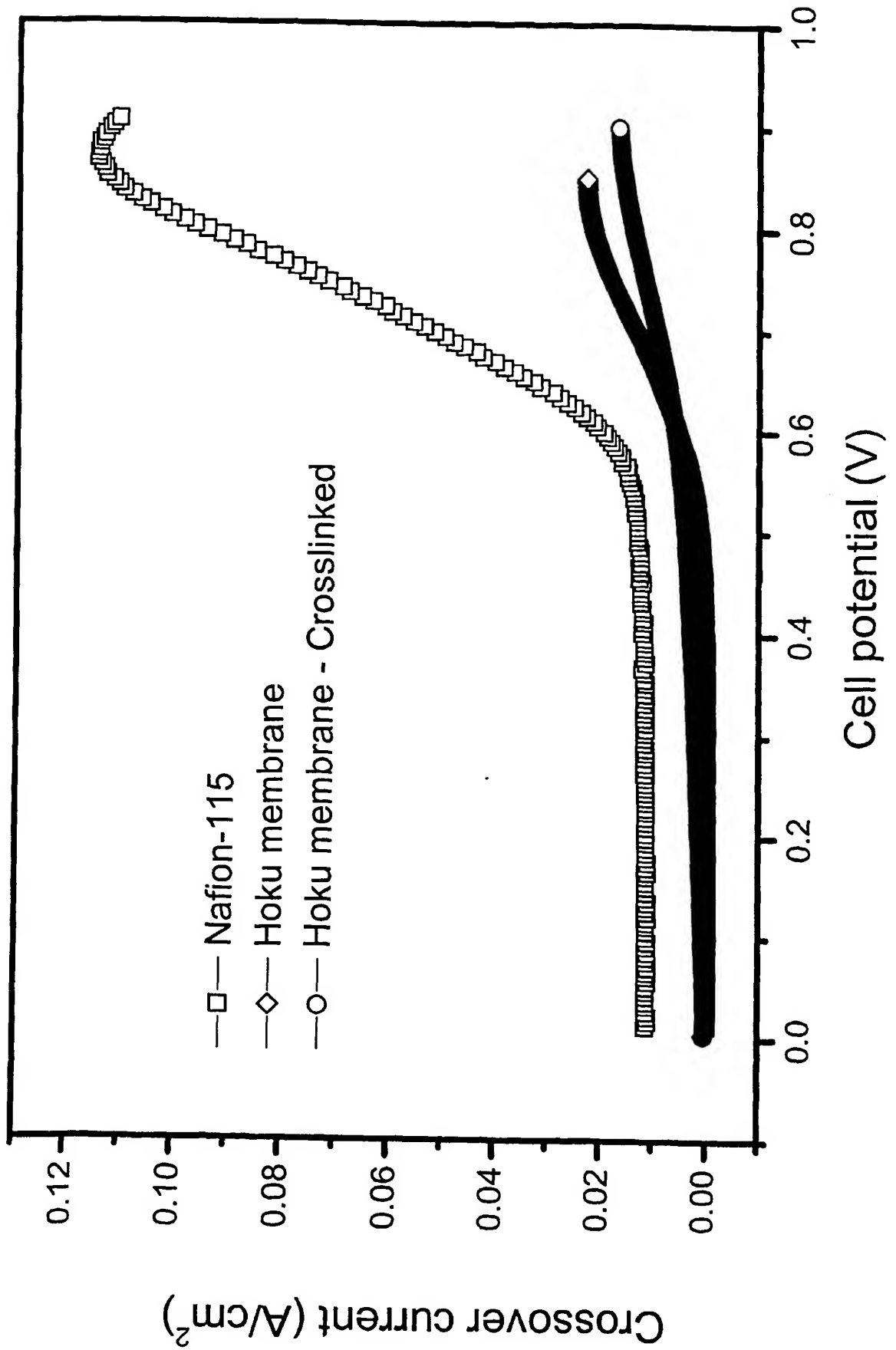
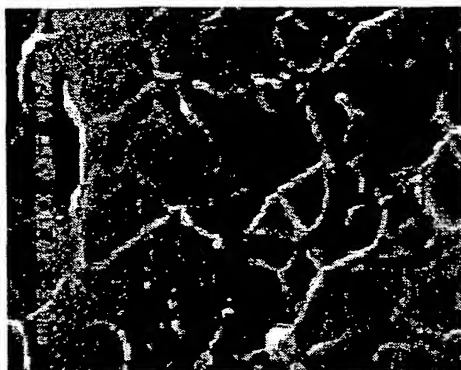
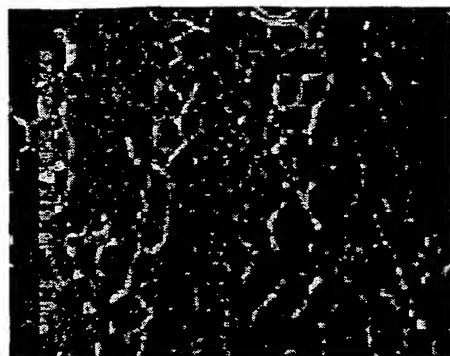


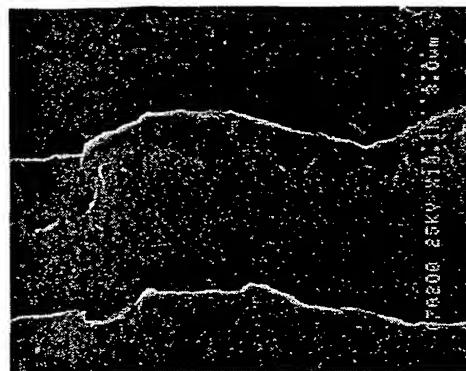
Fig. 2



Picture-1: SEM Image of membrane cross-linked with a 5000 amu cross-linking agent (10.1K Mag.)



Picture-2: SEM image of membrane cross-linked with a 3000 amu cross-linking agent (10.1K Mag.)



Picture-3: SEM image of membrane cross-linked with a 2500 amu Sulfonated cross-linking agent (10.1K Mag.)

Fig. 3

Water Uptake of 35% Sulfonated Ether Ketone Membranes Cross-linked with 5000amu non-Sulfonated Ether Ketone Cross-linking Agent (90°C for 24 hrs)

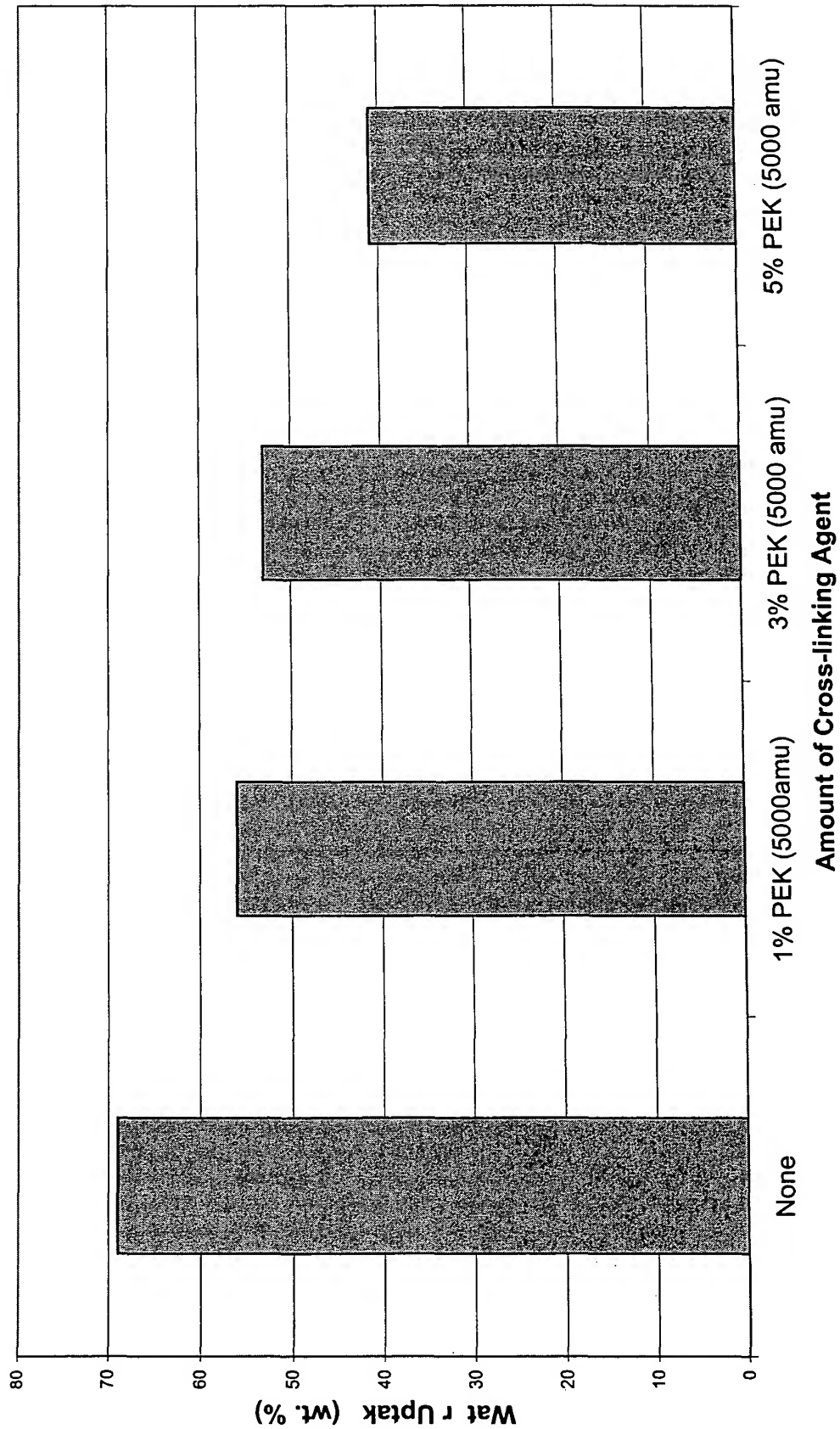


Fig. 4

**Water Uptake of 35% Sulfonated Polyether Ketone Membranes Cross-linked with
3000amu non-Sulfonated Polyether Ketone Cross-linking Agent (90°C for 24 hrs)**

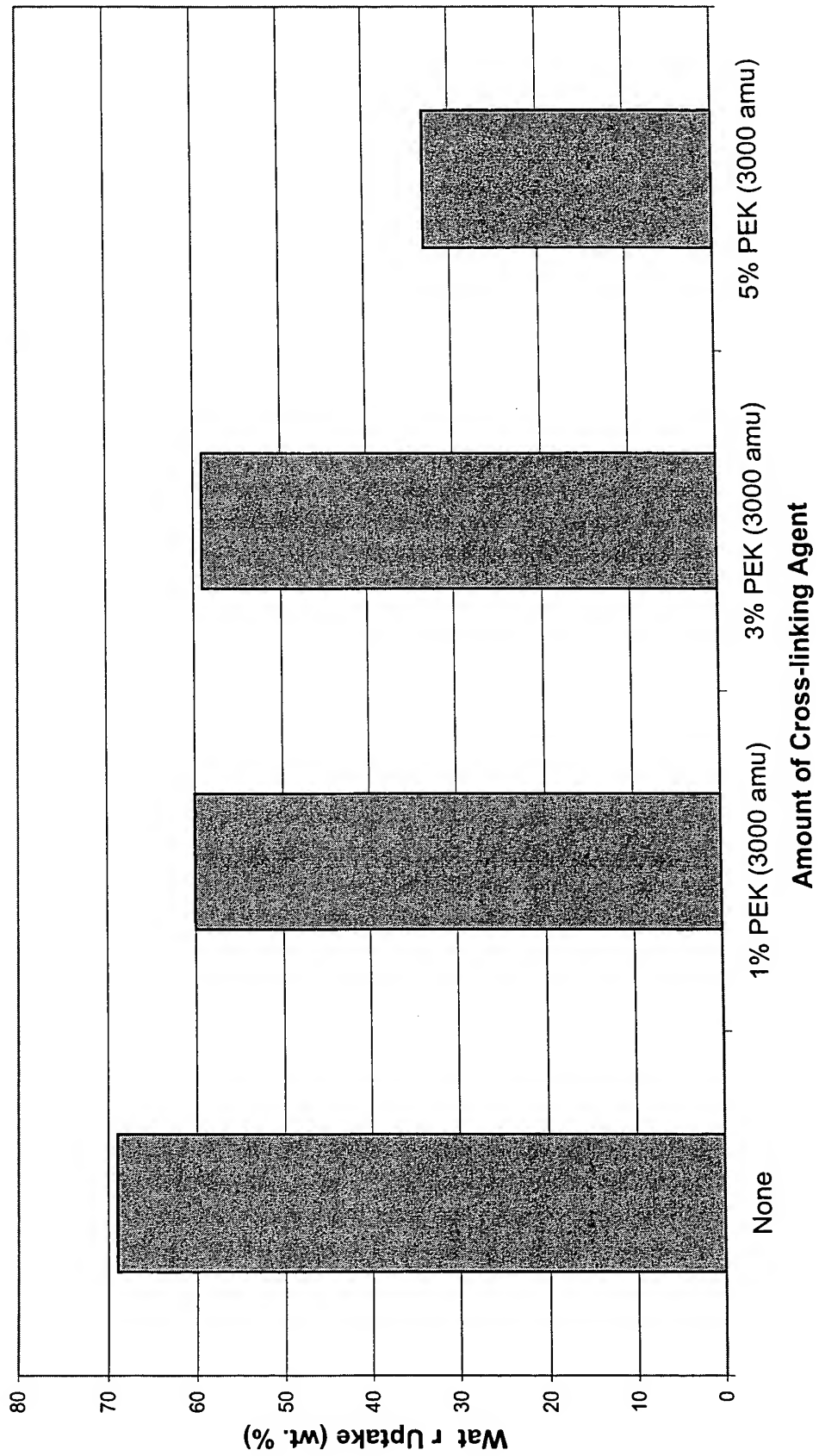


Fig. 5

Water Uptake of 35% Sulfonated Polyether Ketone Membranes Cross-linked with 2500amu 20% Sulfonated Polyether Ketone Cross-linking Agent (90°C for 24 hrs)

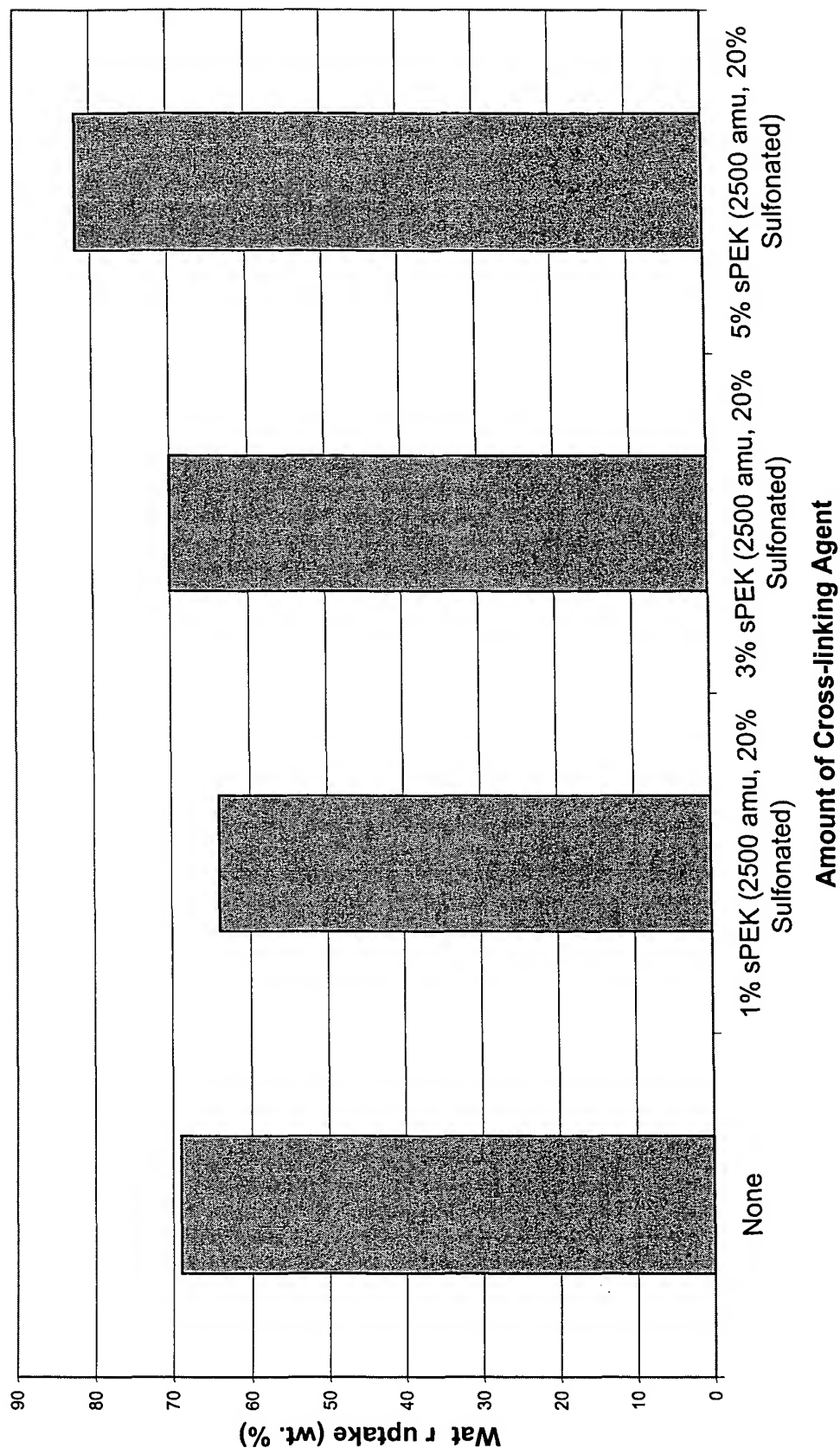


Fig. 6

Conductivity vs. Temperature for Different Levels of Sulfonated Cross-linking Agent (sPEK Base Ion-conducting Material)

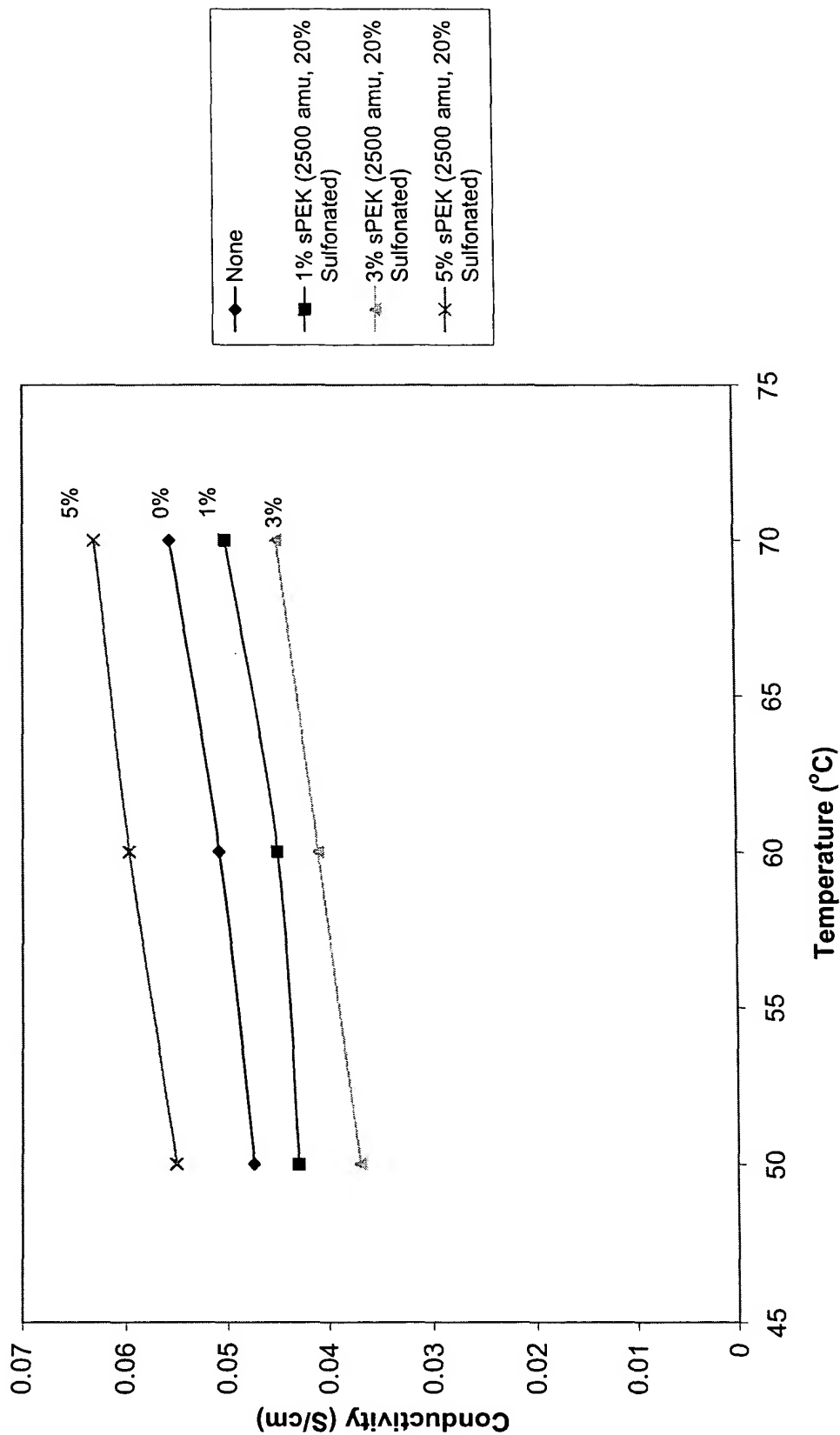


Fig. 7

**Ion Exchange Capacities (IEC) of 35% Sulfonated Polyether Ketone Membranes
Cross-linked with 2500amu 20% Sulfonated Polyether Ketone Cross-linking
Agent**

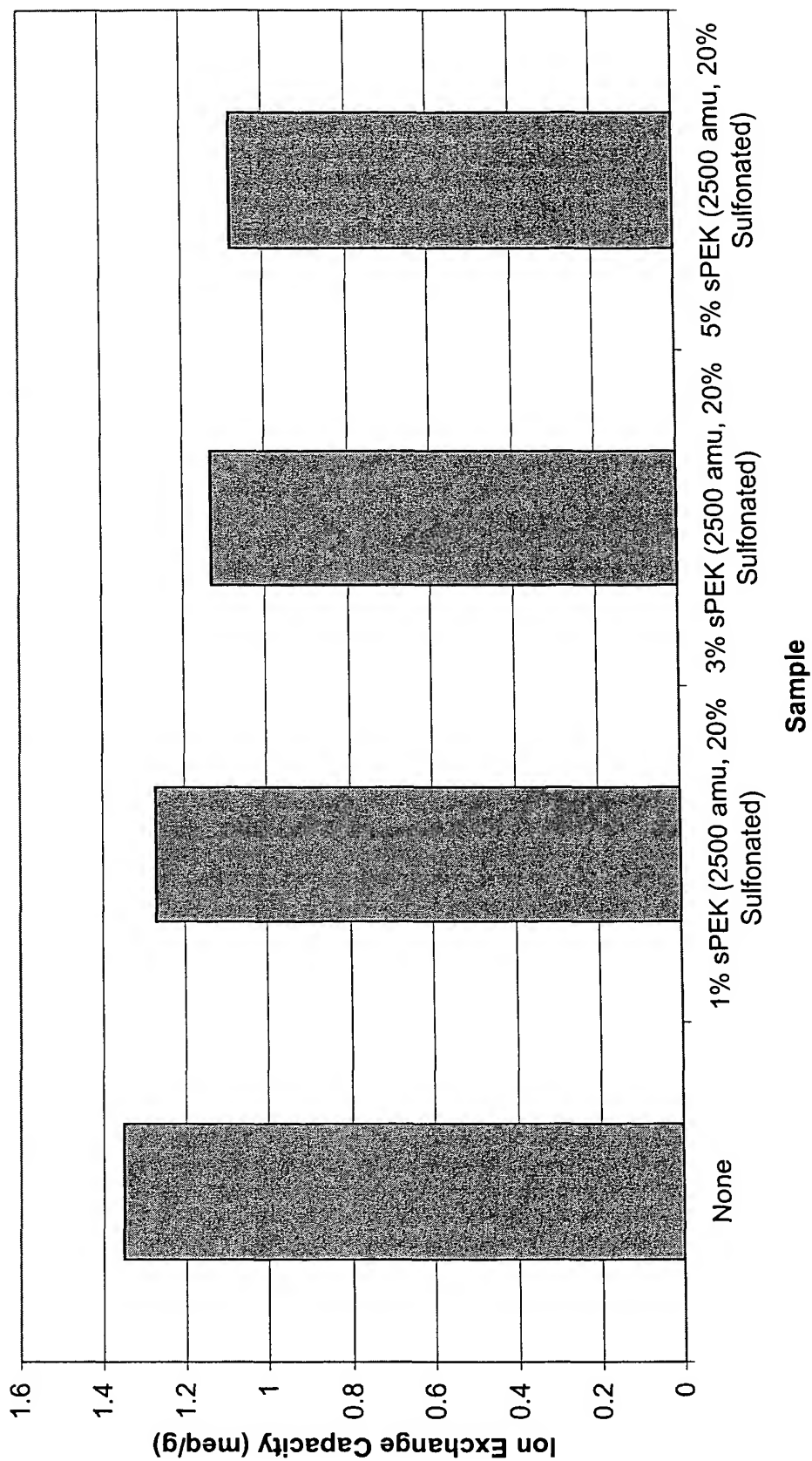


Fig. 8

**Chemical Stability of 35% Sulfonated Polyether Ketone Membranes Cross-linked
 with 5000amu non-Sulfonated Polyether Ketone Cross-linking Agent**

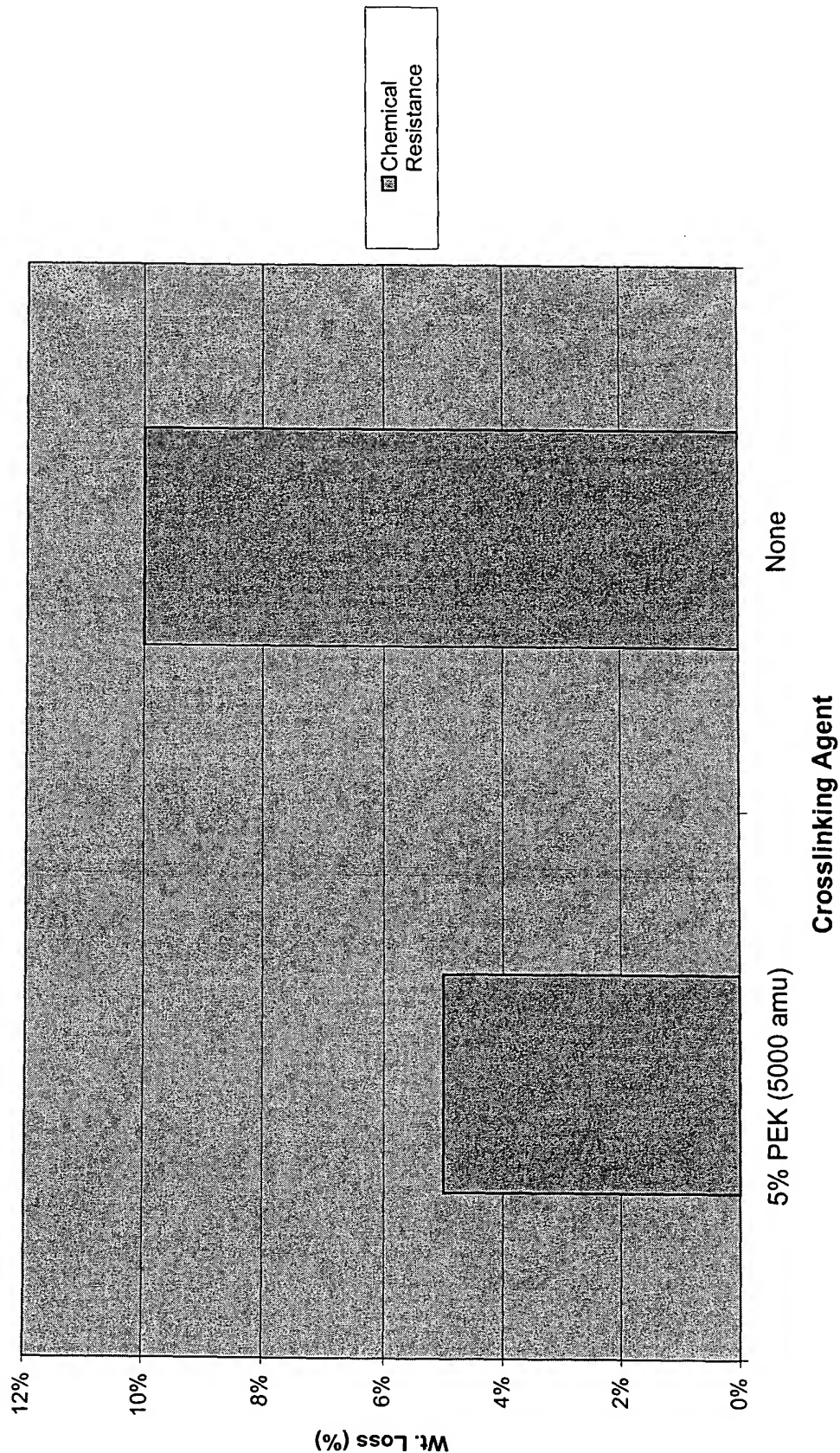


Fig. 9

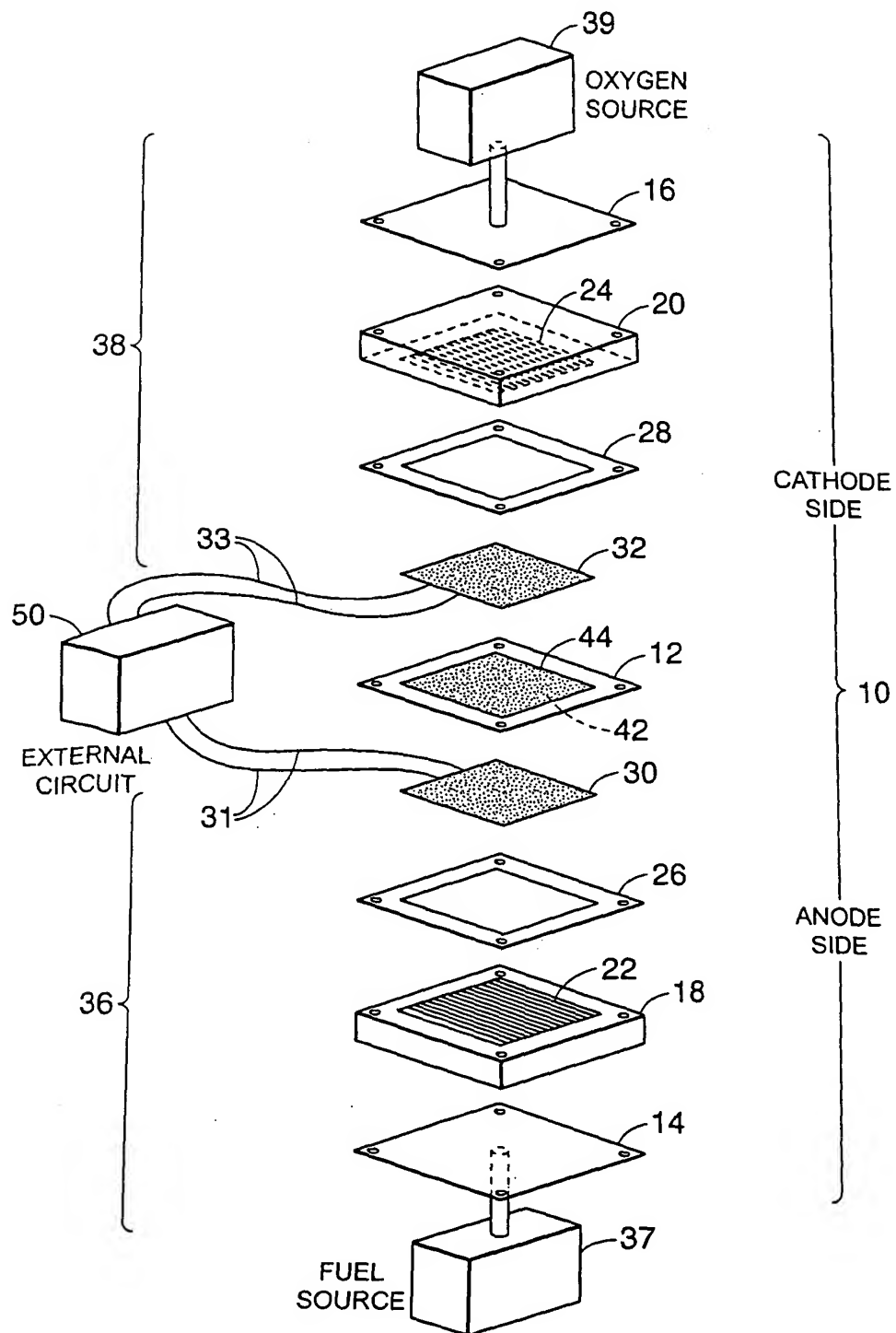


Fig. 10

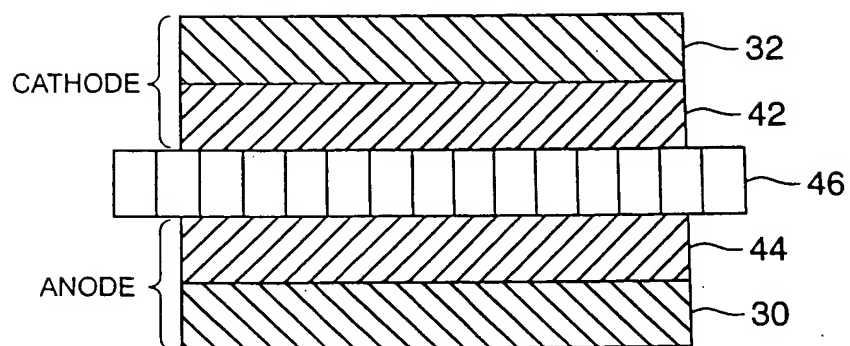


Fig. 11

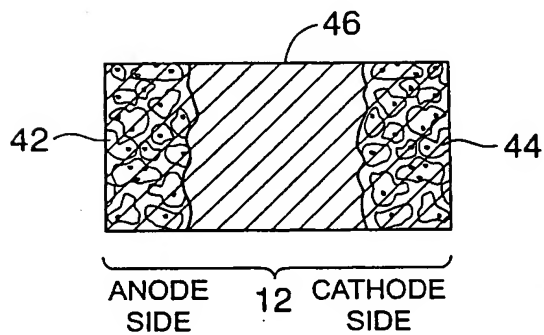


Fig. 12